

Evaluation of Bird Migration using Radar at Proposed Wind Facilities



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Introduction

- A dual marine radar system can provide important ecological information on spatial and temporal movements of bats and birds prior to the construction of wind turbines and during post-construction
 - Post construction studies are much needed to better understand the real risk



Introduction

- Three main aspects of quantifying flight patterns during the preconstruction phase of wind turbine facilities:
 - Flight altitudes
 - Vertical distribution



Introduction

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 - Flight altitudes
 - Vertical distribution
 - Flux
 - Migration intensity



Introduction

- Three aspects of quantifying flight patterns during the preconstruction phase of wind turbine facilities:
 - Flight altitudes
 - Vertical distribution
 - Flux
 - Migration intensity
 - Flight paths
 - Flight directions



Methods

The Merlin dual radar system collects data in both the horizontal and vertical planes

- Horizontal Scanning Radar (HSR)



Methods

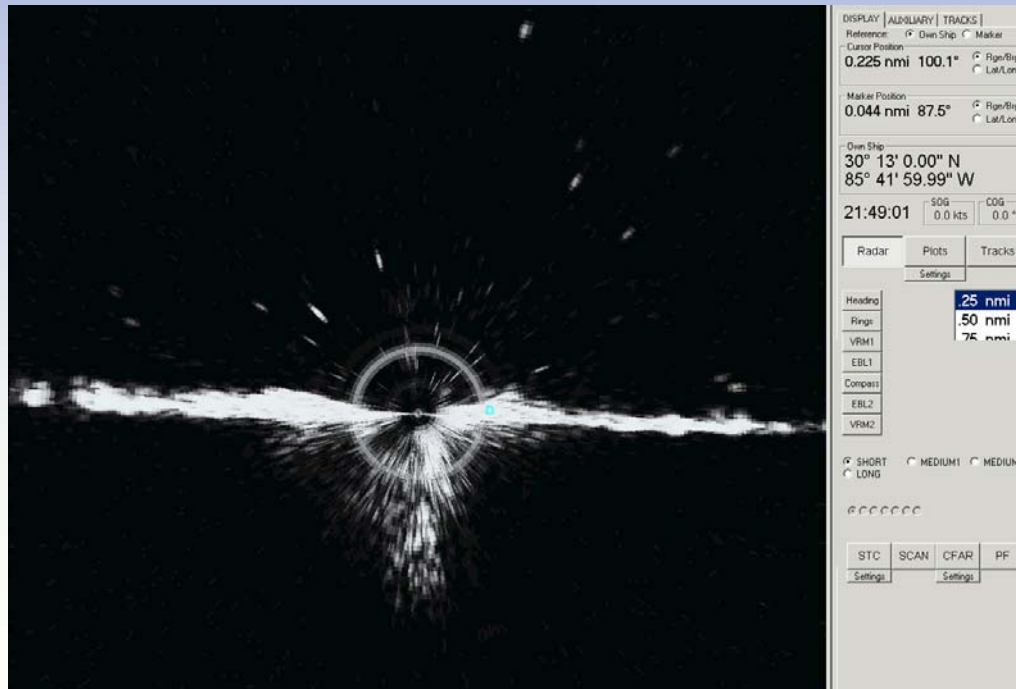
The Merlin dual radar system collects data in both the horizontal and vertical planes

- Vertical Scanning Radar (HSR)



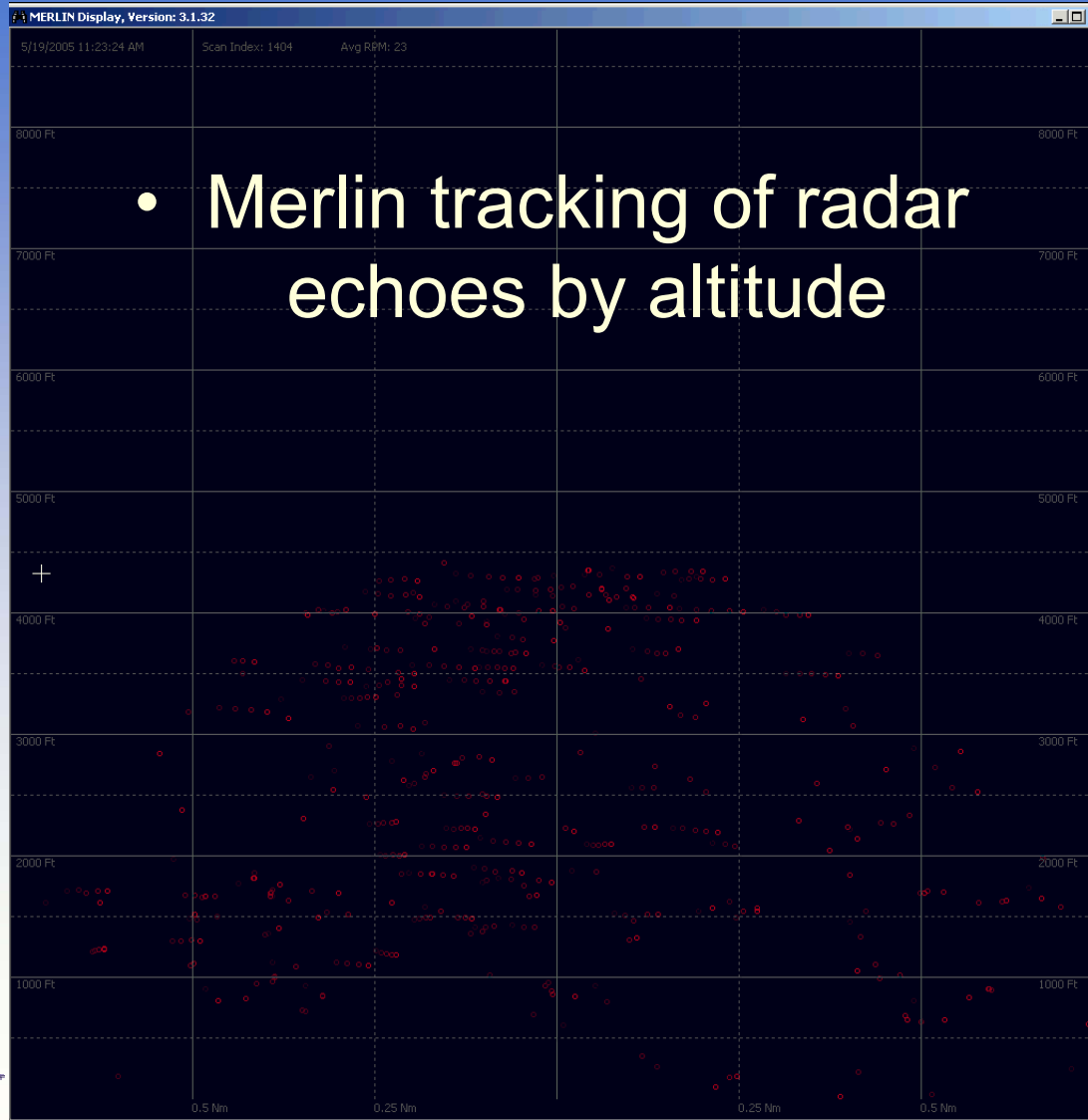
Vertical Scanning Radar (VSR)

- Flight altitudes and fluxes of birds are detected by the VSR
 - Illuminating birds and bats overhead from the radar



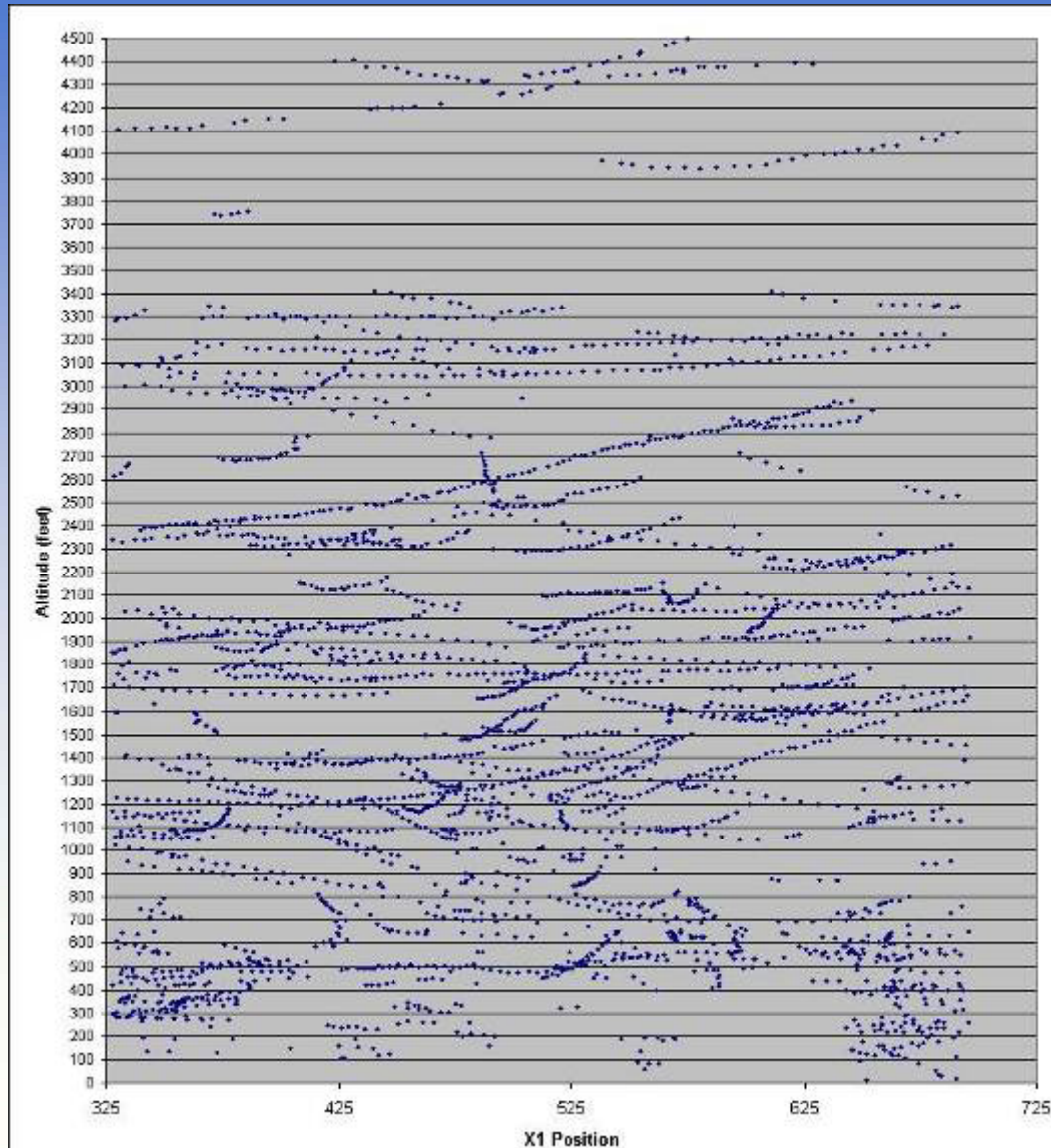
Vertical Scanning Radar

- Merlin tracking of radar echoes by altitude



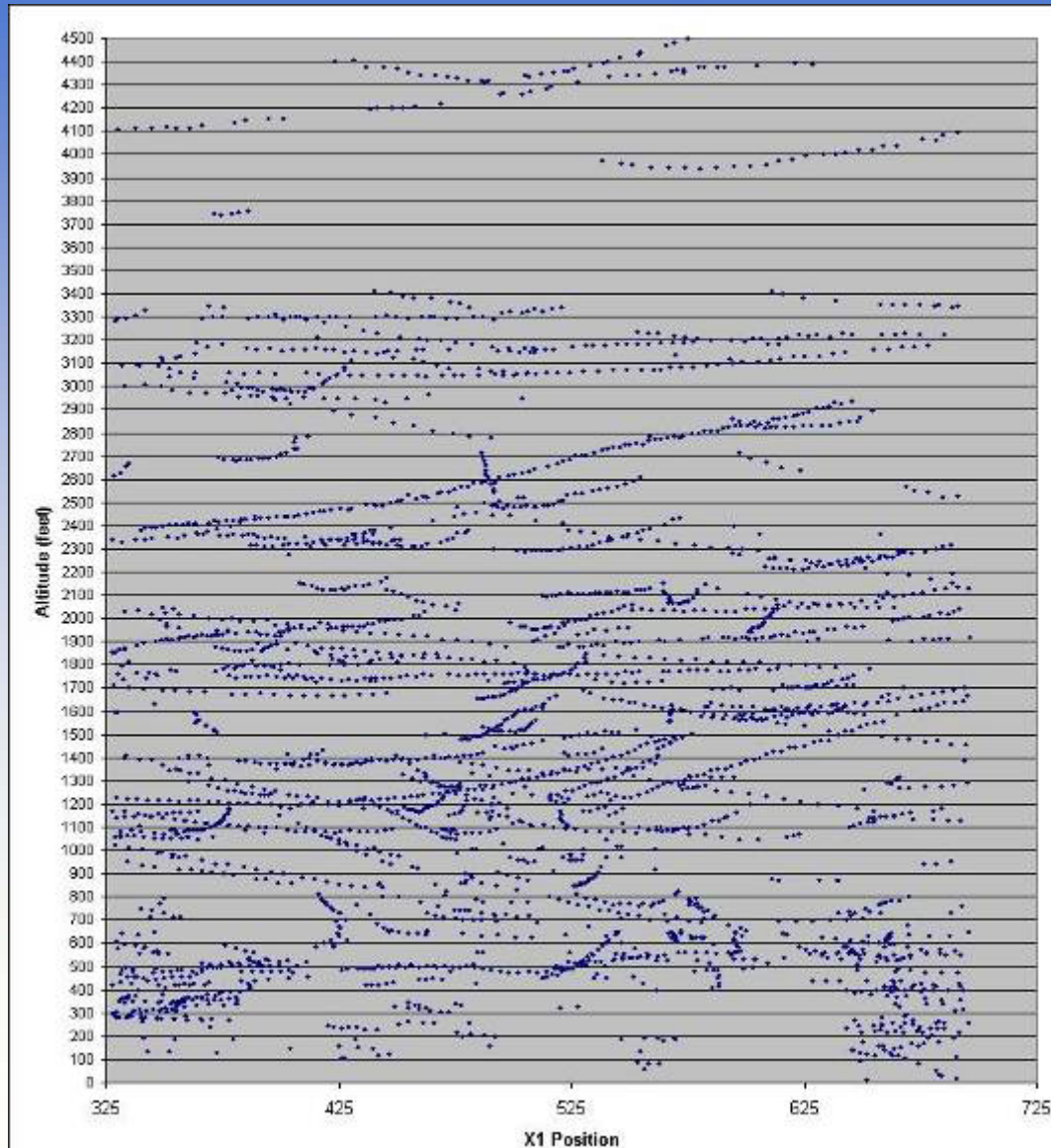
Vertical Scanning Radar

- Querying data for determining Flight altitude distribution
 - Query results plotted for further analysis



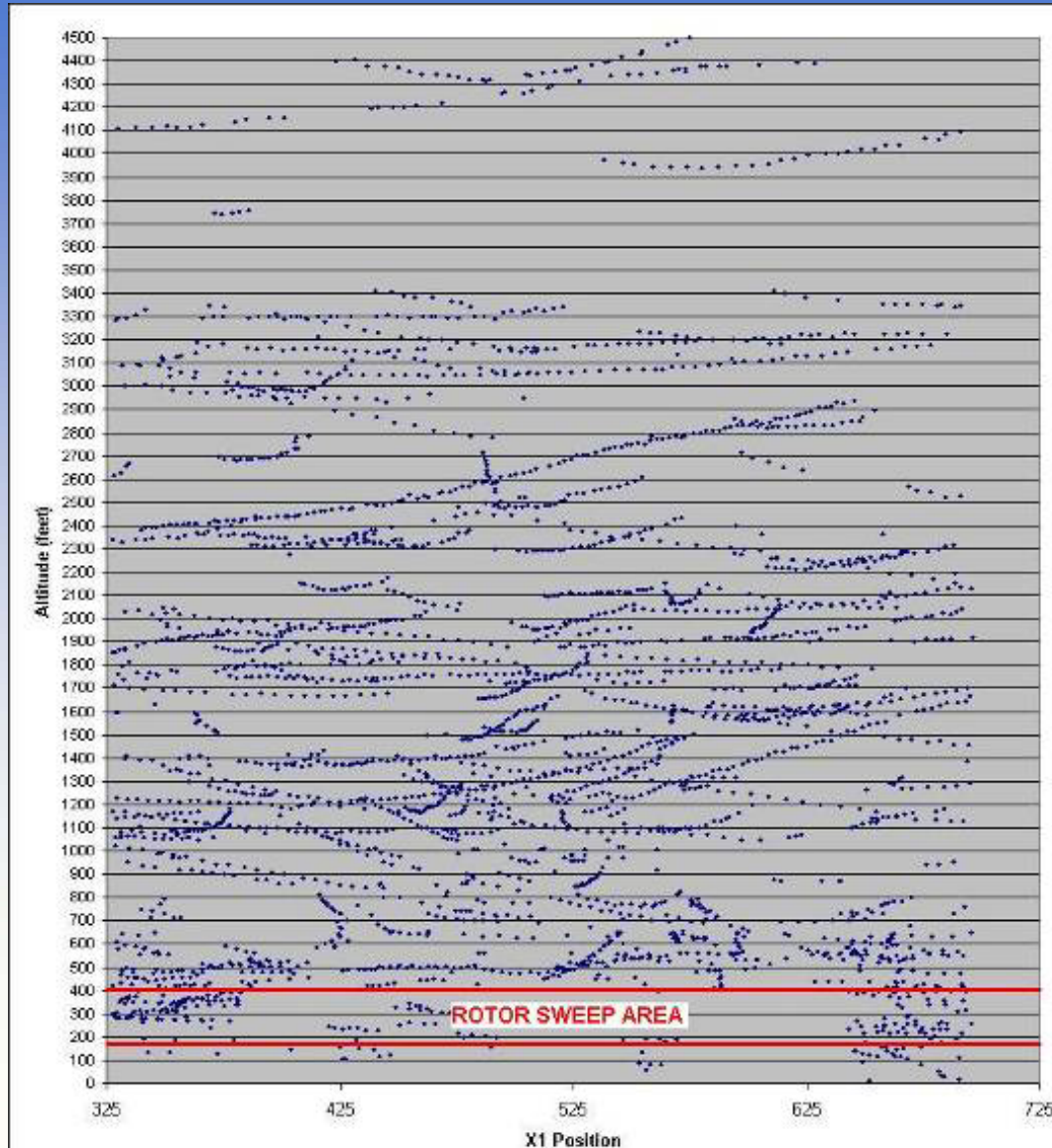
Vertical Scanning Radar

- Querying data for determining flux
 - Mean Traffic Rates (birds/km/hr)



Vertical Scanning Radar

- Querying data for determining flux
 - Mean Traffic Rates (birds/km/hr)
 - Risk within Rotor Sweep Area



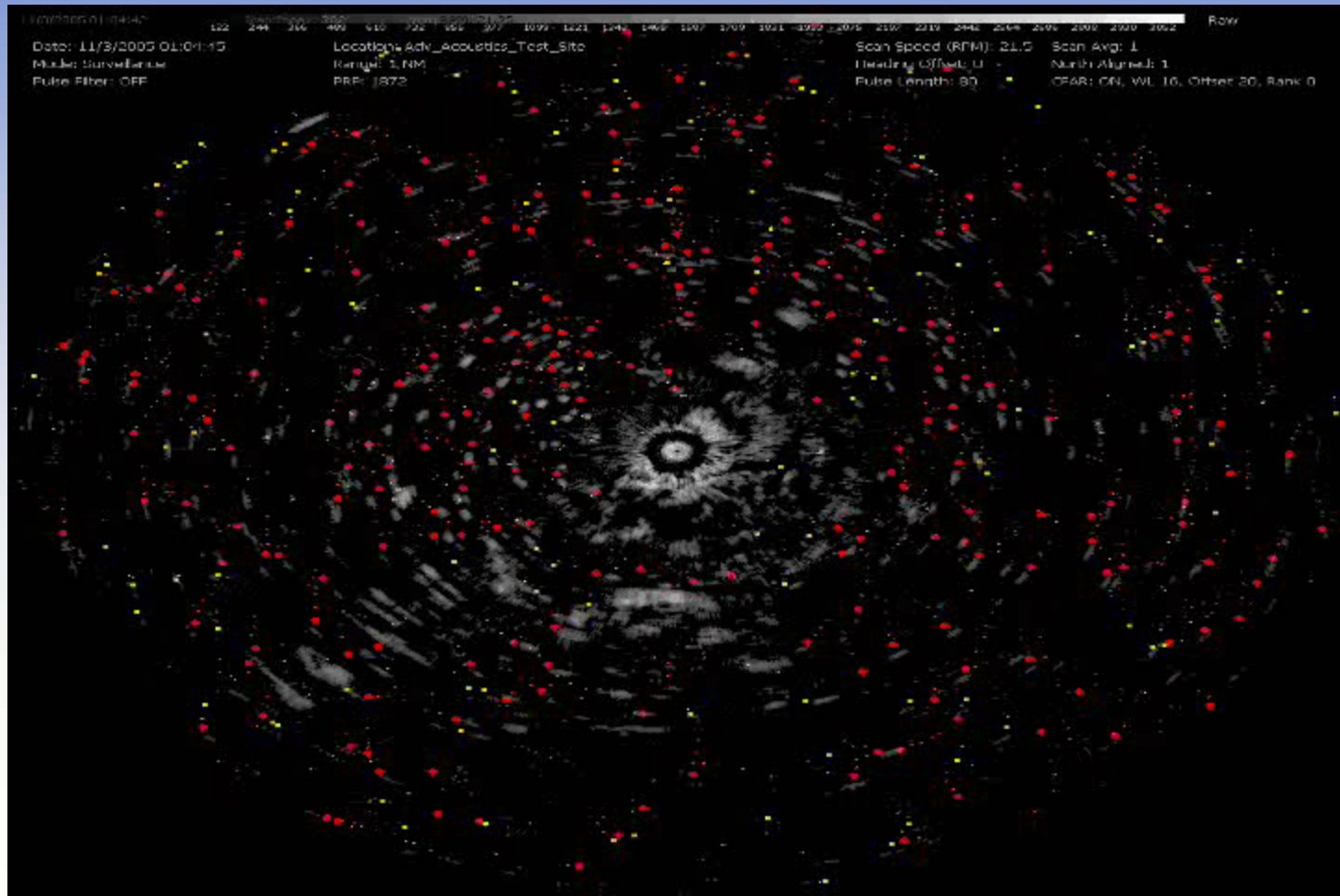
Vertical Scanning Radar (VSR)

- Flight altitudes and fluxes of birds and bats can also be collected by the VSR during post-construction surveys



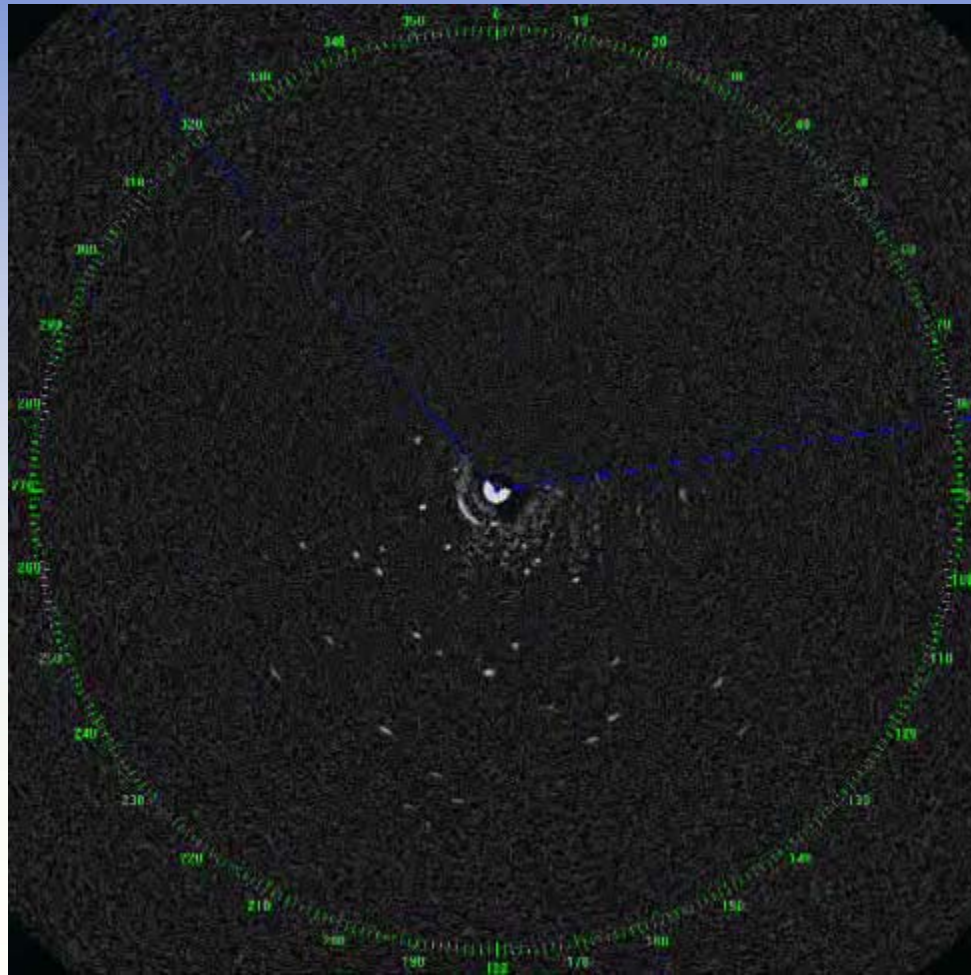
Horizontal Scanning Radar (HSR)

- Flight paths of birds are detected by the HSR



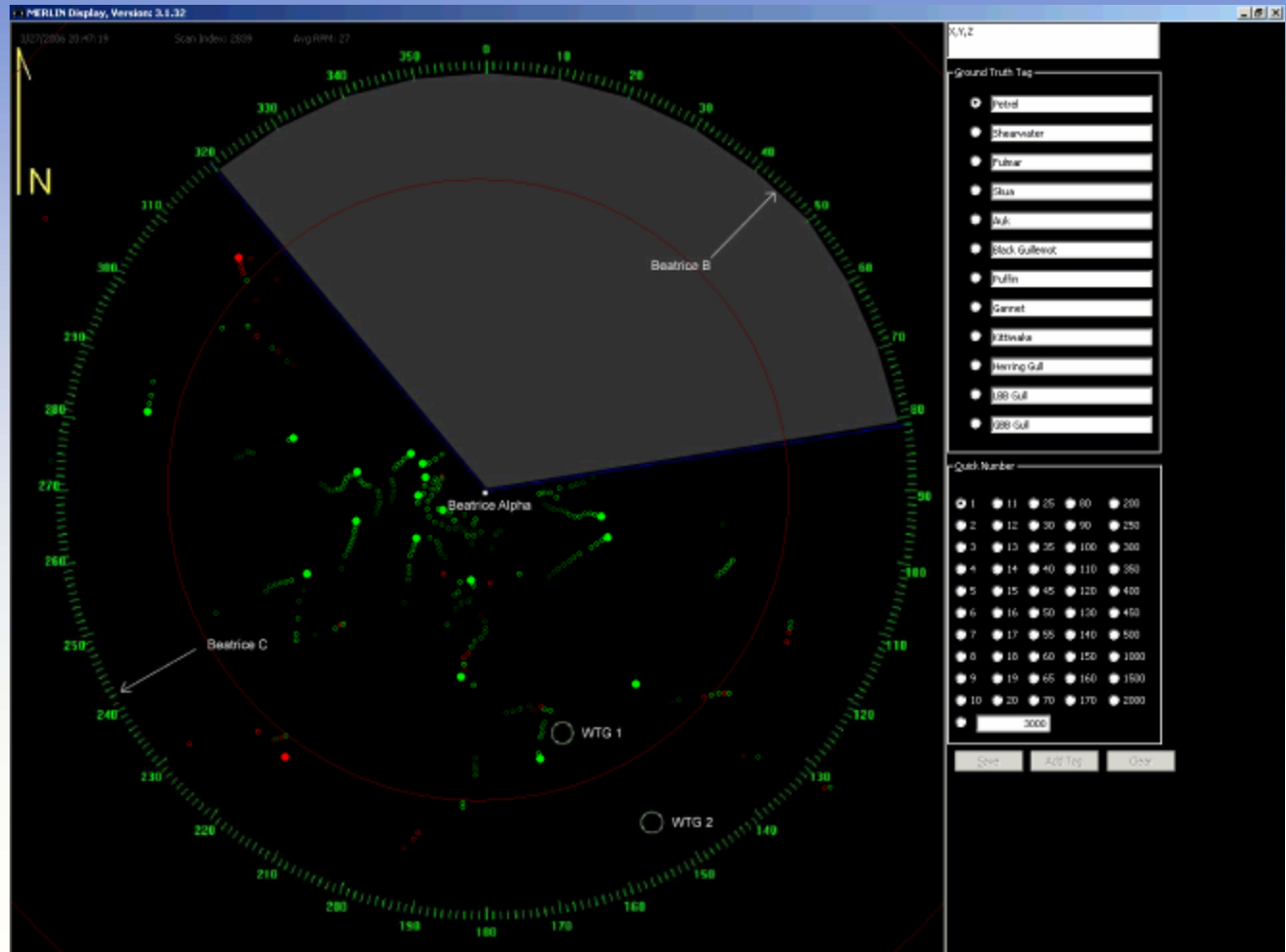
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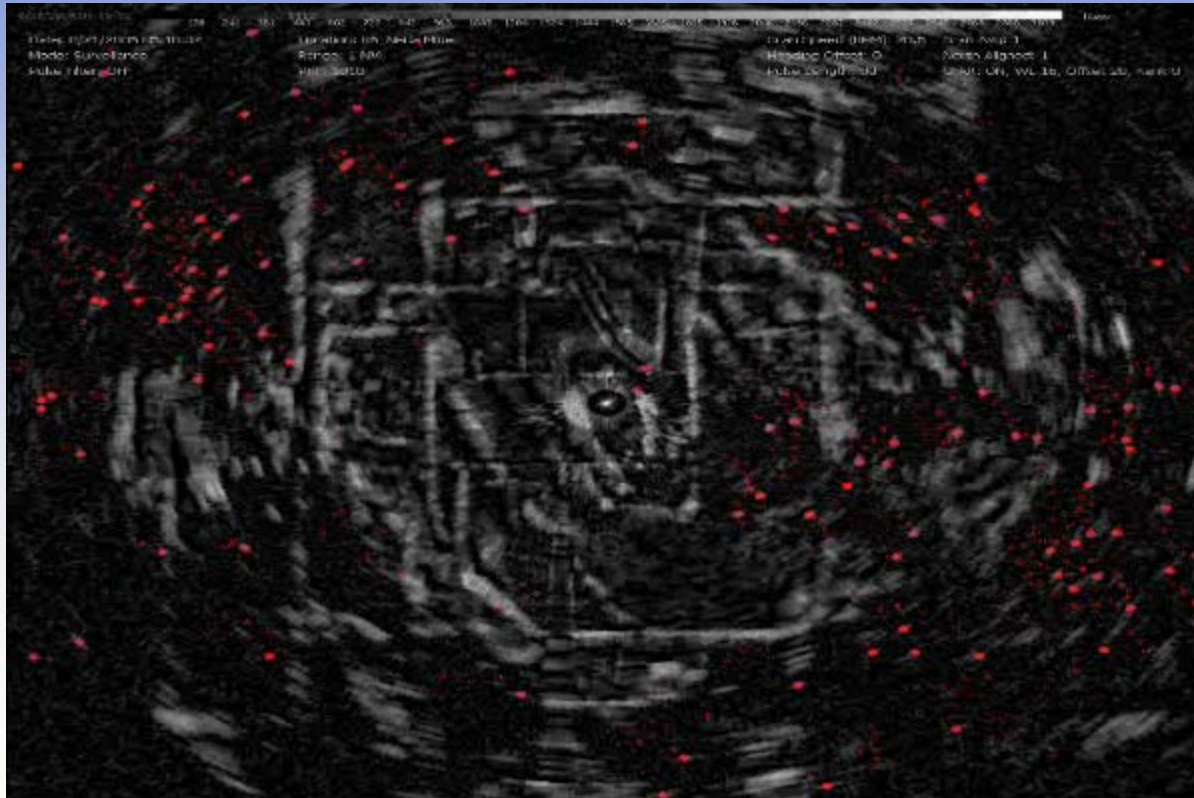
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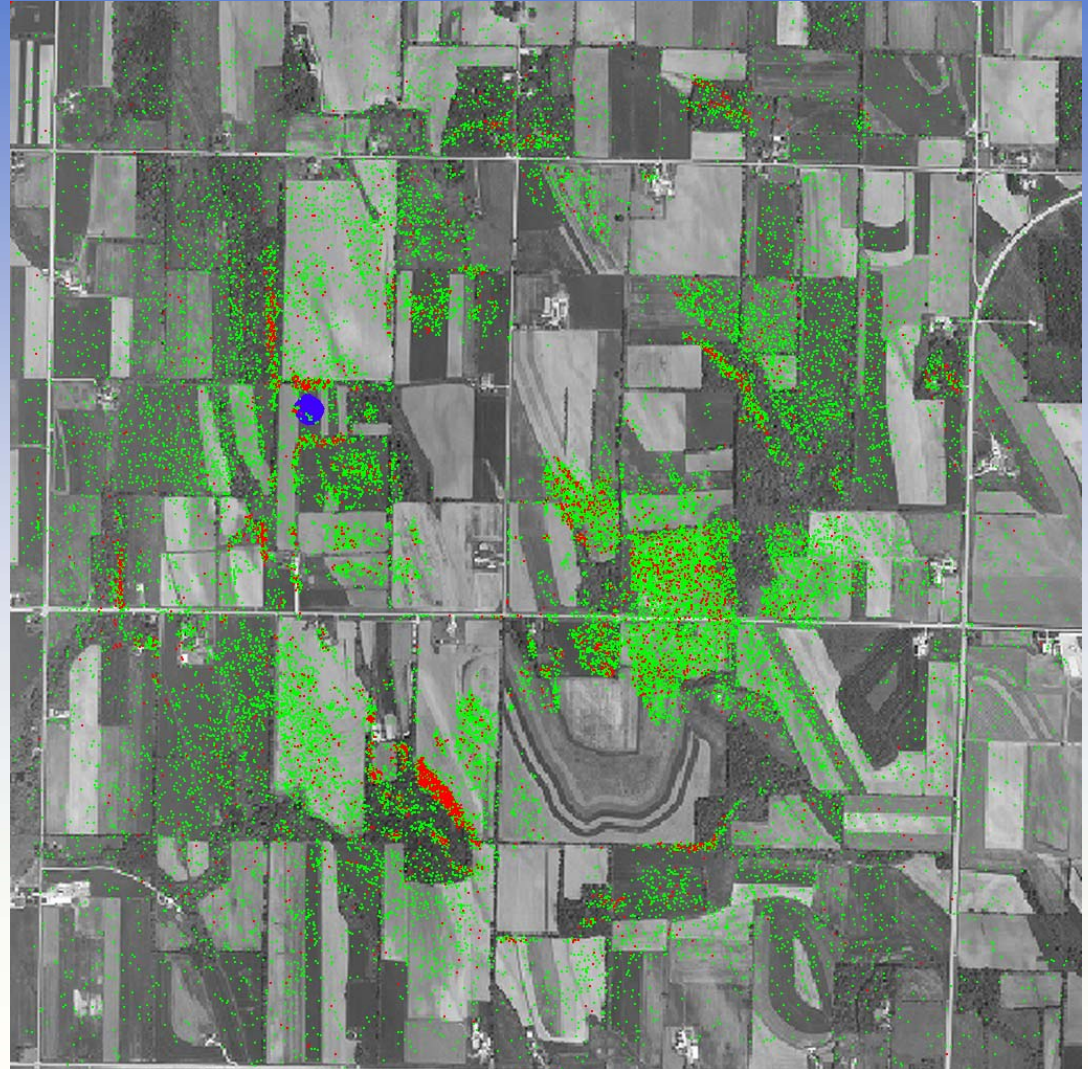
Horizontal Scanning Radar (HSR)

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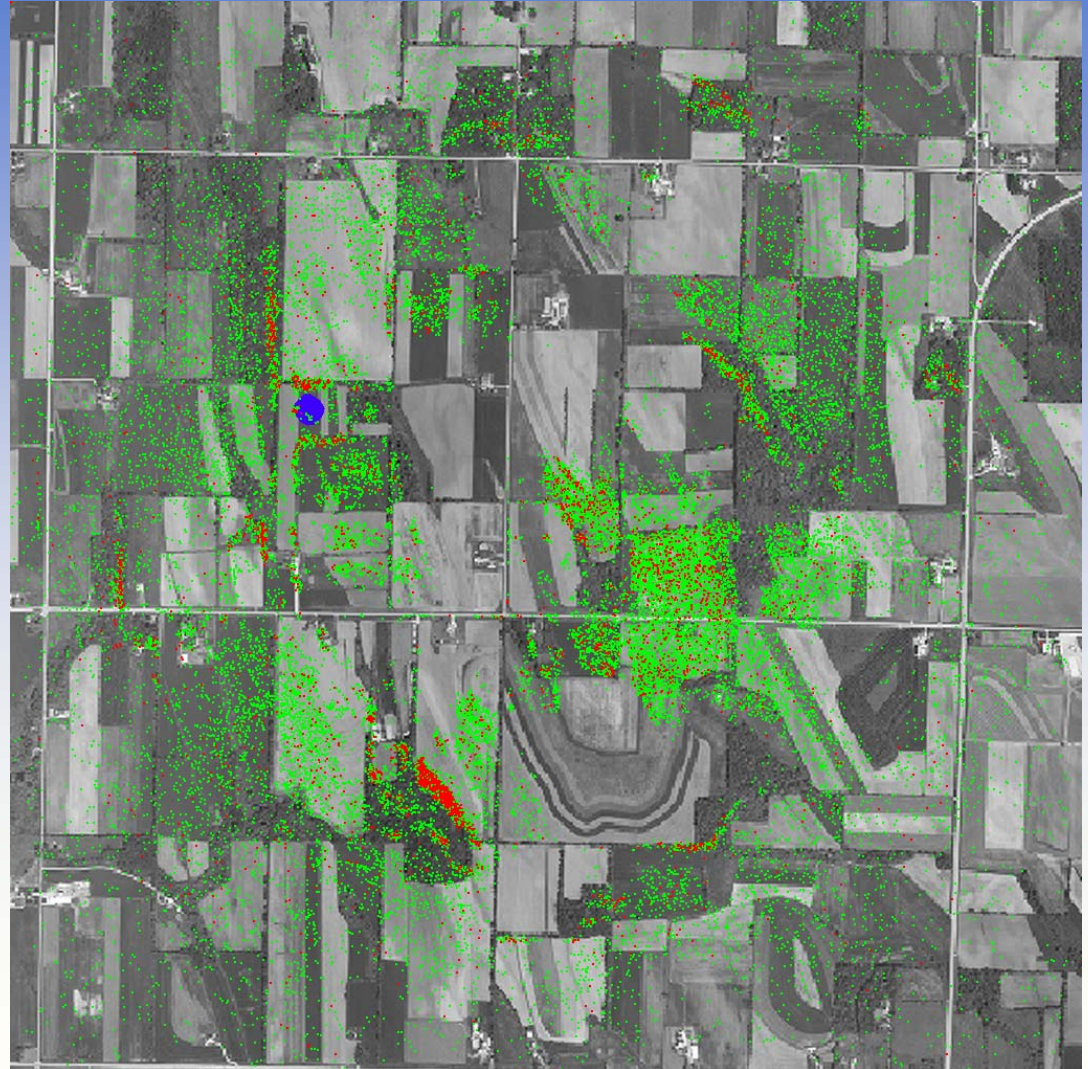
Horizontal Scanning Radar (HSR)

- How do we approach different clutter environments in order to provide the best detection for a bird or bat?



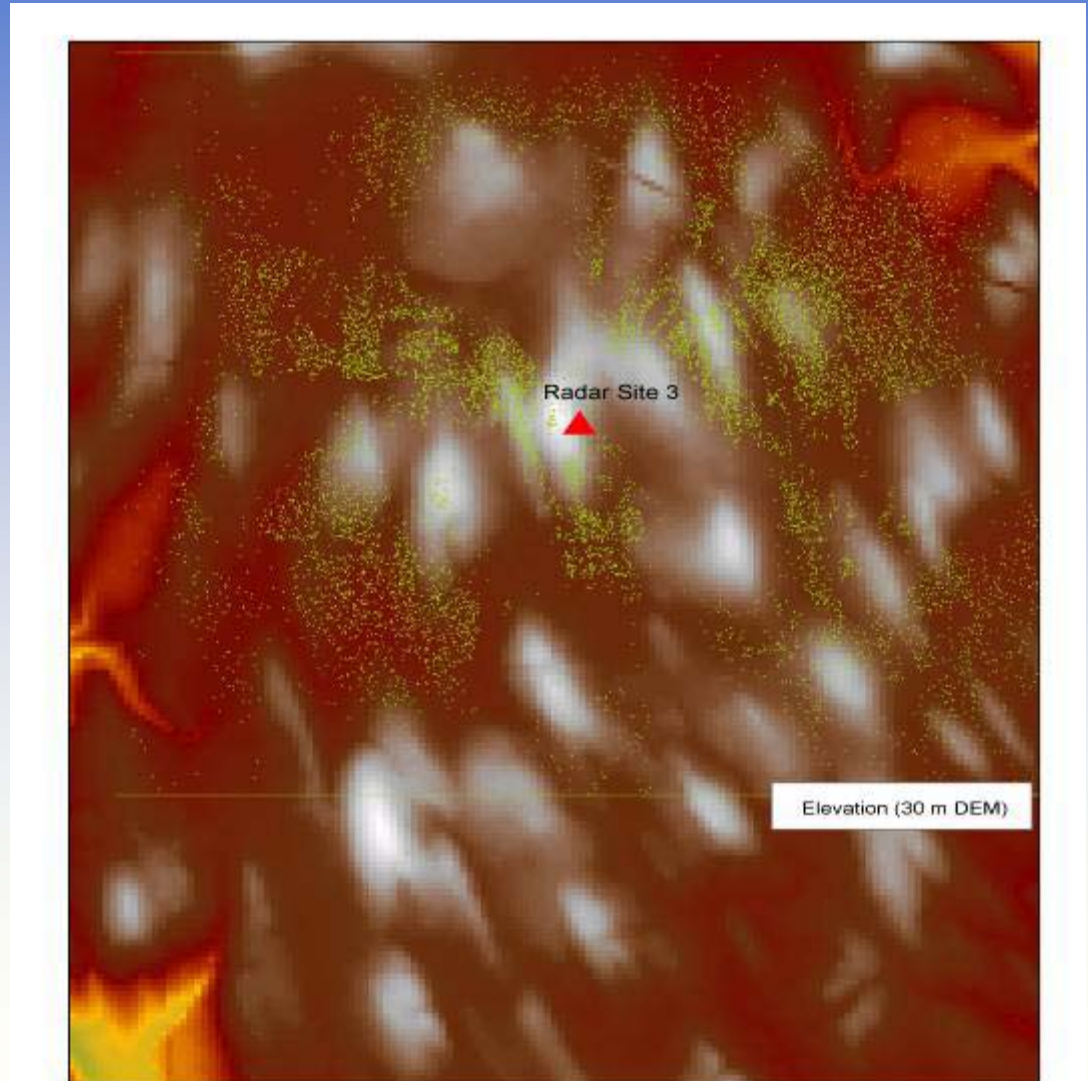
Horizontal Scanning Radar (HSR)

- How do we approach different clutter environments in order to provide the best detection for a bird or bat?
 - Surrounding Vegetation
 - Forest edges
 - Hedgerows
 - Open fields



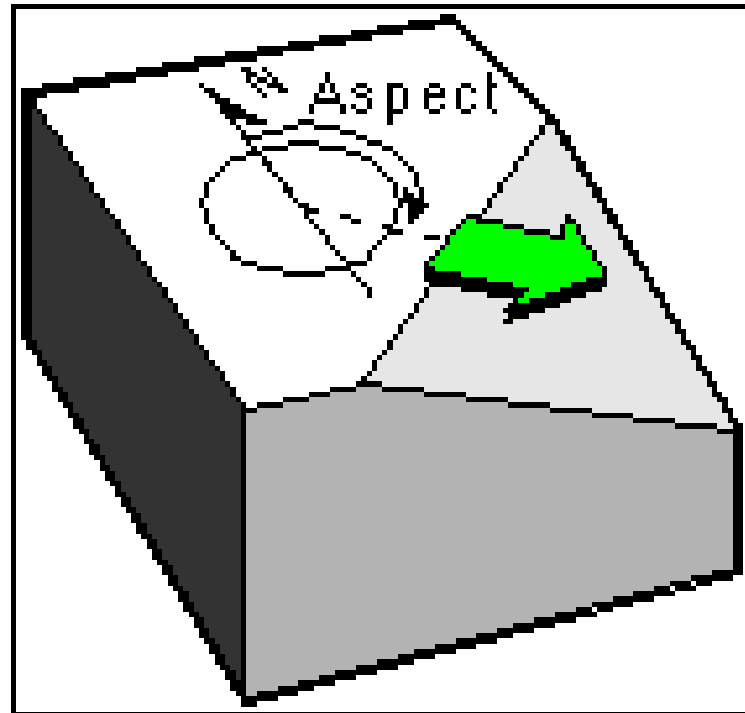
Horizontal Scanning Radar (HSR)

- How do we approach different clutter environments in order to provide the best detection for a bird or bat?
 - Topography
 - Terrain masking



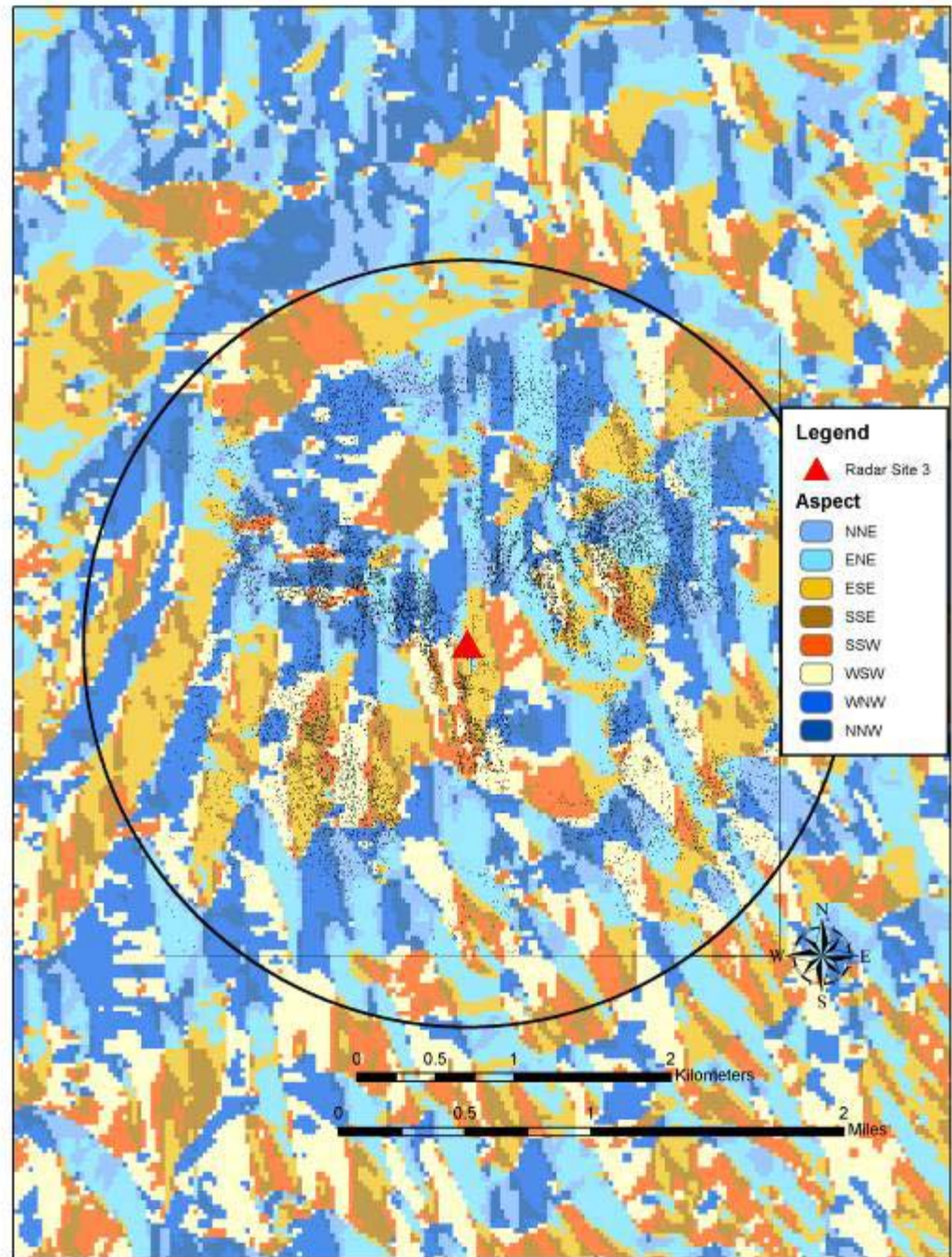
Horizontal Scanning Radar (HSR)

- How do we approach different clutter environments in order to provide the best detection for a bird or bat?
 - Aspect of the surrounding topography in relation to the radar



Horizontal Scanning Radar (HSR)

- How do we approach different clutter environments in order to provide the best detection for a bird or bat?
 - Orientation of slopes can affect the detection of certain targets



Conclusion

Modeling of topography, vegetation and aspect together may prove to be a valuable tool in determining remote sensing location(s) and configuration

- Better layering of verification tools with respect to radar coverage

Acknowledgements

- Thank you for the opportunity to present the hard work performed with my colleagues.
- Special Thanks:
Natural Resources Foundation of Wisconsin, U.S. EPA - Great Lakes National Program Office; Wisconsin Department of Natural Resources